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In a recent Government publication, prepared by Professor F. W. Clarke, S. B., of Cincinnati, we find the following paragraph relating to the purchase of scientific apparatus, which may be studied with profit by the manufacturers:

"Some years ago Congress passed an act authorizing schools and colleges to import apparatus free of duty. This act is not so widely known among teachers as it ought to be, nor do those who know it fully realize the saving in expense which it implies. Goods bought of a local middleman cost their European price, plus a heavy duty and the expense of transportation, with a large profit to the dealer over and above the sum of the foregoing items. A school, by importing its apparatus directly, can save the duties and the local dealer's profit—a retrenchment of from forty to fifty per cent. A hundred dollars thus expended on a direct foreign order will buy as much material as a hundred and fifty laid out at home. A knowledge and an application of these facts will enable many a school to do far more in the way of laboratory work than is considered possible now. To be sure, it is desirable that home trade should be patronized, but not in such a way as to cripple science. The present duties bring in but a trifling revenue to the government and might be abolished without injury to any one. If this were done, our schools and colleges could afford to buy more goods of American dealers; the latter, with larger sales, could ask more reasonable profits; and so both buyer and seller would be benefited.

This paragraph once more revives a question which we trust will not be dismissed until some practical decision has been arrived at. Congress has abolished the duty on scientific apparatus and instruments, in the interest of colleges and other rich corporations, but, demands of the poor student, a tax of fifty per cent. upon every instrument purchased by him.

Such a discrimination in the collection of duties is neither just nor reasonable, and appears to have failed even in achieving any good results in the direction anticipated. On the contrary, it has crippled the business of the American manufacturers, and forced them to charge exorbitant prices on the limited sales they could make under such a system.

We fully concur in the suggestion made by Professor Clarke, that, as these duties bring in but a trifling revenue to the government, they might be abolished, and that without injury to anyone.

We are also glad to find Professor Clarke, while speaking as the representative of the class most benefited by this discriminative legislation, taking such a liberal view, and advocating its entire abolition.

We are unable to offer the view that "the trade" may take on a measure which will bring them in open competition with European manufacturers, possibly they may require to be educated to an apppreciation of a course, that will ultimately result in a condition of business, which will be beneficial to their best interest.

With the abolition of the discrimination in favor of colleges, etc., and of all duties on scientific instruments, the first result would be to equalize the prices of such manufactures, irrespective of the place where they are made. Universities and colleges in such a case could afford to buy of the domestic manufacturer and would doubtless do so. The one point that would have to be considered in such an open market, would be that of *quality*, and the American manufacturer of scientific apparatus has nothing to fear on that head, while with larger sales more reasonable profits could be accepted; thus both buyer and seller would be benefited. We trust that the next Congress will take some action in this matter, and place scientific apparatus and instruments on the free list of the tariff, and thus remove an obnoxious tax on knowledge, and increase the facilities for the acquisition of scientific and technical education among the masses of the people.

We are informed that Dr. T. Sterry Hunt, of Montreal, and Professor James Wall, sailed for Europe on the 10th instant, for the purpose of attending the International Geological Congress, to be held at Bologna, Italy, on the 26th of September. We have written to Dr. T. Sterry Hunt, who is both a subscriber and contributor to this journal, to send us a report of this meeting, and have no doubt that we shall be thus enabled to place before our readers a reliable account of the doings of this Congress.

We understand the Edison Light Company has been notified that the French Government, after inspecting all the electric lights in the Paris Electrical Exposition, has selected the Edison Company to light the Grand Opera-house of Paris with the Edison electric light. The Edison Company will ship the necessary electrical machinery to France by the next French steamer, and will light up 800 Edison electric lamps in the opera-house on Oct. 7.

HISTORIC NOTES OF COSMIC PHYSIOLOGY.*

By Dr. T. Sterry Hunt.

[Abstract.]

The author began by insisting that general physiology, as the philosophy of material nature, is co-extensive with general physiography, in which sense it was employed by the best writers up to the first year of this century. In the abridgements of the Philosophical Transactions of the Royal Society up to 1700, and to 1720, the chief division is into Mathematical and Physiological subjects, the latter including the phenomena of the three kingdoms of nature. There is a physiology not only of animals and plants, but of the inorganic world, and from terrestrial physiology we rise to a conception of the physiology of the Cosmos or material universe; a subject which from the earliest times has attracted the attention of philosophers. One of the most evident of the problems thus presented is that of interstellar space, and its relations to our earth and its gaseous envelope. After noticing the views of the ancient Greeks, the author referred to the discovery by Alhazen of the refraction of light, from the phenomena of which the Arab philosopher attempted to fix the limit of the terrestial atmosphere. He then noticed the similar attempts of later observers, and adverted to the well-known hypothesis of Wollaston, who endeavored to assign thereto an absolute limit on grounds which are inadmissible. He adverted to various views as to the so-called ether of space, which Newton thought, must include exhalations from celestial bodies, and noticed the hypothesis of Grove that the medium for the transmission of radiant energy through space is but a more attenuated form of the matter which constitutes the gaseous envelopes of the earth and other celestial bodies, between which, through this medium, Grove supposed material interchanges might take place. The suggestion of Arago as to the possibility of determining the density of the rare matter of interstellar space was noticed, as well as that of Sir William Thomson, who has even attempted to fix the minimum density of the luminiferous medium, which he, like Grove, conceives may be a rarified extension of the terrestrial atmosphere. Mattieu Williams, adopting the hypothesis of the atmospheric nature of the interstellary matter, has attempted to show how the sun in its course through space may condense this matter with the evolution of heat and thus replenish the solar fires. From this ether also by a stoichiogenic process the various chemical species are perhaps generated.

The author had endeavored to approach the study of interstellary matter from a wholly different side. From a consideration of the chemical and geological changes of which we have evidence in the earth's crust since the beginning of life on the planet, it is clear that enormous volumes of carbonic dioxide have become fixed partly in the form of carbon, with evolution of oxygen, and partly as carbonates—equal in the aggregate to 200 atmospheres or more. This enormous volume, it is held, must have come from outer space to supply the gradual absorption of the gas from the atmosphere, while by a reverse process of diffusion the great amount of liberated oxygen may have been got rid of, and the equilibrium of the atmosphere in this way maintained. The consequences, both meteorological and geological of this process were discussed by the author in 1878, and more fully in 1880 in an essay on The Chemical and Geological Relations of the Atmosphere in the *American Journal of Science*. As a farther contribution to the history of these views, the author proceeded to show that Sir Isaac Newton not only held to the presence in interstellar space of exhalations from the sun, the fixed stars, and the tails of comets, which he supposed to become diffused in and to form part of the ether, but even suggested that this etherial matter is the solar fuel and essential to planetary life. From a consideration of the processes of vegetable growth and decay, Newton arrived at the conclusion that elements from interstellar space, brought by gravity within the terrestrial atmosphere, serve to nourish vegetation, and by its decay are converted into solid substances. In this way are, according to him, generated not only combustible (sulphureous) bodies, but calcareous and other stones, whereby the mass of the planet is augmented. These views put forward in Newton's famous Hypothesis concerning Light and Color in 1675, and in the Queries to the *Optics*, are more definitely enunciated in Propositions 41 and 42 of Book III of the *Principia*.

* Read before the A. A. A. S., Cincinnati, 1881.

ON THE UNIFICATION OF GEOLOGICAL NOMENCLATURE.

By Richard Owen.

With a view to proposing such Geological Terminology as would probably be acceptable to a large majority of the scientific representatives of those nations sending delegates to the International Congress for the Unification of Geological Nomenclature, it seems necessary to offer for discussion some principles, and to lay down some

SUGGESTIVE RULES:

1. To agree that all questions shall be decided by a plurality vote; or, if thought best, by a two-third majority.

2. To assign distinctive names for the headings of geological divisions and subdivisions, instead of calling, for instance the "Silurian," sometimes an "Age," at others a "Period, System, Era, Formation," or as by the French "Etage," which is translated by Surenne as meaning (when applied to Geology) stratum or layer. Further suggestions on this point will be given in the "Conspectus of Headings."

3. To arrange under these heads, when thus decided upon, such formations as are generally considered of nearly coördinate value, in lieu of giving the same apparent importance to a minor subdivision, say of Upper Silurian (such as Salina), or one of the Devonian (e. g. Chemung) that we assign to the whole Tertiary. The subjoined Tabular View offers a modified coördination.

4. To select, as far as practicable, for the geological formations thus arranged, geographical terms, indicating the areas where these formations prevail extensively, or have been studied very thoroughly. This would obviate any controversy on mooted points regarding the lithological or paleontological character of the formation. In order to illustrate the practical application of this rule, let us take for examination the nomenclature proposed by the illustrious Sir R. Marchison, in his great work of 1854, "Siluria," descriptive of the geological formation in the country inhabited by the ancient "Silures." His work of 1839 was entitled "The Silurian System," but his later publication showed a preference for the shorter and more expressive form as a noun. The adjective has, with slight modifications, been adopted in most modern languages; but by selecting the noun "Siluria," we unify for universal recognition. The same may be said for "Devonia." If it is not considered too great an innovation to alter terms already so well received, we might say "Silur-Britannia," "Devon-Caledonia," and proceed then to distribute the honors among different nationalities, as more fully exhibited in the Conspectus. The term Carboniferous is not correct when applied to Mountain Limestone or Millstone Grit, besides Coal Measures cannot be so rendered into other modern languages as to make a suitable subdivision, it is therefore suggested to name the system after the region having the greatest Coal area (the United States), and the Coal Measures after a European country in which coal is well developed. This would give us Appalachia or Carbon-Appalachia for the system, and Belgia for

the productive Era, while the great development of Millstone Grit in Ireland furnishes the term "Hibernia," and the celebrated Adelsberg grotto or cave in Mountain Limestone suggests the term "Austria," as appropriate for that Era. So also Perm-Russia, because the Permian system prevails so extensively from Kasan to the Gulf of Tscheskaïa, near the White Sea; Trias-Germania, because the Germans have given to all geologists the subdivision of that system (Bunter, Muschelkalk and Keuper) also Jura-Gallia, because the system prevails largely, and has been studied minutely in France. This plan of nomenclature would also serve to recall to the geologist, and convey to the student, important facts regarding the distribution of the formation.

5. Somewhat in the same manner, uniformity might be given to the names of nonfossiliferous rocks, by adopting Dr. Dana's orthography, as given in his latest works, where he employs the letter "y" instead of "i" as in Granyte, to distinguish rocks from minerals with names ending in "ite." Even the final "e" may as well be omitted in order to unify for other languages; and we then have, for example, Granyt, Syenyt, etc., or we may even so apply the rule as to have international names for Limestone, Sandstone, Magnesian limestone and the like, calling them Calkyt, Silikyt, Dotomyt, etc. Some German scientists (see Cotta's "Gesteinslehre") use, for instance, the word Quartzit, writing it however with an "i."

6. It is thought further that, in many cases, geological terms might be abbreviated, so as to be readily intelligible in all languages, somewhat on the symbolic system adopted in chemistry. A conspectus of the proposed modifications in geological nomenclature, with a column

SUGGESTIVE CONSPECTUS, TOWARDS UNIFICATION OF GEOLOGICAL NOMENCLATURE.

EON.	PERIOD.	ERA.	EPOCH.	EQUIVALENTS.
Neozoic or Quaternary	XIII. Cimbria	33 Antillia or Gaudeloupia	b Mentonia a Neandertha	Recent — Modern — Neolithic, Paledithic
		32 Madagascaria	b Nile-Gange a Nora-Toxandria (or Auckland-Kawhia)-(New Zealand)	Reindeer
	XII. Patagonia	31 Scythia or Siberia	a Rhenus-Port Hudsonia (Loess)	Champlain — Alluvium
		30 Pampas-Virginia	b Ebor-nora-Kentuckyia (Newburg, N. Y., and Big-bone Lick) a Darling—Australia	Diluvium
	XI. Scandinavia	29 Suedia	b Regio Grœnlandica	Glacial or Drift
		28 Laboradoria	a Arctico-Boria or Borea	
Cenozoic or Tertiary	X. Ter-Pliocene or Italia	27 Sicilia	a Girgenti—Catania b Etruria—Apulia	Pliocene — Sumter (Dana) Aralo—Caspian of Lyell
		26 Subapenninia	a Carolina—Virginia	
	IX. Ter-Miocene or Græcia	25 Emodi—India (Himalaya)	b Sivalik—Pannonia a Cecropia—Sardinia (or Pikermi, or Pentelicus-Sar)	Miocene — Yorktown
		24 Helvetia	b Caucaso—Tongria a Spitzbergen—Alaskia	
	VIII. Ter-Eocene or Afric-Asia	23 Parisia	b Alabama—Georgia a Berlin—Westphalia	Eocene — Alabama
		22 Aegypto—Persia or Suessonia	b Tyrol—Istria a Dalmatia—Syria	Lignitic Epoch
Mesozoic or Secondary	VII. Creta-Hispania	21 Anglo-Senonia	Mæstricht—Venetia Pyrenœi—Carpatesia	Cretaceous — Up. Wh. Chalk Lower do.
		20 Lusitania	Texas—Niobraria Dacia—Cimmeria	Upper Green sand
		19 Neocomia	Magellan—Circassia Wealden — Sussexia-Néocomien of d'Orbigny	Lower do.
	VI. Jura-Gallia	18 Portlandia	Calais—Bononia- (Boulogne sur mer)	Jurassic — Wealden
		17 Bavaria	Solenkofen—Oxfordia	Oolitic Epoch
		16 Vindelicia	Boll—Avonia	Liassic do.
	V. Trias-Germania	15 Bolivia	Cheshire—Somersetia	Triassic — Keuper
		14 Hanoveria	Beaufort—Lunevillia (Dieynodon and Ceratites nodosus)	Muschelkalk
		13 Saxonia	Brunopolis—Polonia Brunswick loc. Eng. lilif. Connecticut—Moravia	Bunter
Paleozoic or Primary	IV. Perm—Russia	12 Kasan-Tscheskaïa	Thuringia Nosgesusia	Permian
	III. Carbonaria or Carbon-Appalachia	11 Carbonia or Belgia	Missouri—Pennsylvania Namur—Coimbria Michigan—Tasmania	Carboniterous — Coal Measure
		10 Hibernia	Monongolia (W. Virginia) Cumbria (Yorkshire Mt.) Adelsberg—Nova Scotia Iowaia — Kaskaskia, St. Louis, etc., etc., etc.	Millstone Grit
		9 —— Austria Subcarb[5] 9° —— Alemania	Waverleyia (Ohio) Volga—Uralia	Subcarb[5] Limestone or Sandstone
	II. Devonia or Devon-Caledonia	8 Livonia or Caledonia	Villmar—Catskillia Nassau—Westphalia or Franconia	Devonian — Catskil Chemung
		7 Rhen—Prussia	Plymouth—Eifelia Hamilton—Chemungia	
		6 Neregonia (Norway)	Cathay—Potoria Dalecartia	Hamilton Corniferou
	I. Siluria or Silur-Britannia	5 Scania	Gottland—Tyrolia Helderberg—Ludlovia	Silurian — Upper — Helderberg
		4 Niagaria	Medina—Clintonia Wenlock—Pentlandia	Niagara
		3 Boiohemia or Trentonia	Augers—Hudsonia Caradoc—Trentonia	
		2 Canadia	Vitré—Murcia Llandeils—Esthonia	Lower — Trenton Canadian
		1 Cambria	Potsdam—Longmyndia Acadia	Cambrian

DIFFERENT HEADINGS, WITH ONE OR TWO EXAMPLES.

MACROCHRONE.	EON.	PERIOD.	ERA.	EPOCH.	MICHROCHRONE.
(Greatly extended time.) *Examples.* Neptunia (all aqueous rocks.)	("A space of time, a life-time.") Paleozoic Eon.	("An inteival of indefinite time.") Permia Carbonaria Devonia Siluria	("A succession of years between two fixed points.") Austria (Mt. limest.) Cambria	("A pause.") Iowaia Potsdamia Acadia	(Comparatively short time.) Karkaskia, St. Louis, etc., etc.

EXAMPLES SHOWING THE ADAPTABILITY OF CERTAIN HEADINGS TO MOST OF THE MODERN LANGUAGES.

		System. ("An assemblage of objects ranged in regular sub-ordination, or related by some common law.") Σύδεημχ (το) Le système. Das System, Il sistéma. El sistéma.	*Sub-system.*	*Group.* ("An assemblage of objects in a certain order.") Le Groupe. Die Grüggen. Il grúppo. El grúpo.	*Sub-group* or *Section.* Sectio. La section. Die section. La sezione. La seccion. or *grade* or *member*, with slight modifications can be used in the above languages.

ABBREVIATED FORMS WITH SOME EXAMPLES.

		For *Periods.* Roman numerals, I, II, III, etc., or Capital letters A B C, etc., applied thus: I = Silusia. or A = "	For *Eras.* Arabic numerals 1, 2, 3, etc., applied thus: 2. = Canadia 1. = Cambria	For *Epochs.* Small letters a, b, c, etc., [repeated for the epochs of each era.] 2^b= Vitrè-Murcia 2^a=Llandeils-Esthonia 1^b= Potsdamia 1^a= Acadia	For *Members*, marks used to the right and above the era letter, similar to the power-sign in mathematics. Thus to designate the Burlington member of the Iowa subcarniferous, we would write: III. $9^{a''}$ or C. $9^{\circ}a''$

of the leading present equivalents is submitted below, in which it will be observed that one great object, kept in view, was the recording particularly by the Epoch names, such localities as are noted for having given us remarkable fossils, characteristic of that peculiar formation, whether found in well-known regions of Europe and America, or in such distant countries as Patagonia, N. Zealand, the Cape of Good Hope, Greenland or Spitzburgen, etc.

NOTE TO TABLE 1.

To further facilitate the understanding of some of the suggestions submitted, a tabular view is subjoined, giving different headings, with their definitions from standard dictionaries, as well as a conspectus of the symbols.

NOTE TO TABLE 2.

Probably some difficulties, and, despite of care exercised, some errors in the details may be pointed out; but if the general principles are found acceptable, or suggestive of such discussion as may ultimately lead to unification of our Geological Nomenclature, the object proposed, in the preparation of this paper, will be attained.

A NEW MATERIAL FOR STOP-COCKS AND STOPPERS FOR REAGENT BOTTLES.*

BY H. W. WILEY.

For some time I have been working with a compound invented by Mr. T. J. Mayall, of Reading, Mass., and known as the Mayall metal. One form of this compound was intended as a material for journals, pneumatic tubes, etc. It is made of 5 to 6 parts graphite, 1 part rubber and ½ part sulphur. Instead of sulphur, sulphide of antimony can be used. The material is a perfect self-lubricant and to a high degree resists the action of acids and alkalis.

From its properties I was led to believe that it would be especially useful for chemical apparatus, in the manufacture of stop-cocks, connecting tubes, etc. My expectations were fully realized.

I have used it with success for burettes, cocks for hydro-sulphuric acid, stoppers for hydrote bottles, etc, These never stick, no difference how firmly they are pressed in nor how long they are left. The material is firm and elastic and will hold threads nearly as well as a metal.

I regard it as peculiarly useful for stop-cocks for acids, especially hydro-sulphuric. It is capable of a high polish, and will not tarnish. Slightly modified in composition it is used for covering houses and plating the bottoms of ships. Placed on ships it seems to prevent entirely the adhesion of barnacles, Strange as it may seem, it also makes an excellent insulating material for telegraph wires. I have not yet tried the effect of ozone upon it and only partially of permanganate of potassium.

* Read before the A. A. A. S., Cincinnati, 1881.

PHONETICS OF THE KAYOWE LANGUAGE.*

BY ALBERT S. GATSCHET.

Books printed in Indian languages often render those tongues in a most imperfect manner, on account of the deficient knowledge of Indian phonetics on the part of the authors. The Kayowe language is a fair average specimen of Indian pronunciation, and is very rich in sounds, having no less than forty-four sounds, if we count in the long and the nasalized vowels. In its phonetic series the most conspicuous fact is the prevalence of the nasals and the total absence of dsh, tch, which are so conspicuously frequent in the majority of American languages, of r and of v. The palatal series is represented by one consonant only; the guttural and dental series are well represented, while in the labial series p, b, and m are the only frequent sounds. F is found in some words only, where it alternates with p, pai, or fai, land, earth. Among the sounds not frequently met with are sh, w

* Read before the A. A. A. S., Cincinnati, 1881.

Nasalizing is a prominent feature in Kayowe phonetics, more so in the vocalic than in the consonantic series No word begins in l or w. Final syllables of words terminate just as often on a consonant as in a vowel, but all other syllables usually end in a clear or nasalized vowel. Every diphthong is adulterine; that is, every combination of two colliding vowels differing from each other can be pronounced as a monosyllable and a dissyllable. Thus we can pronounce as well ze-iba as zeiba arrow. The fact that every vowel can become nasalized (and many of the consonants also) is one of the curious features of the language. This nasalization is either the one observed in the French an, in, on, un, or it consists in the addition of an n to the vowel. All these Kayowe peculiarities are very commonly observed in the majority of American languages, and also in most of the unwritten languages of other parts of the world. The standard orthography which is adopted for recording a written literary language exercises undoubtedly some influence upon the pronunciation of the natives, but where the language is not fixed by writing, we perceive constant alternation of the sounds pronounced with the same vocal organ, as of the gutturals, dentals, and labials among themselves.

"This is also the case in Kayowe, and a full list of the sounds in it is as follows:

CONSONANTS:

Gutturals: k, g, kh (aspirate), h, ng.
Palatals: y.
Linguals: *k*, g, sh, l.
Dentals: t, d̄, s̄, z, n, nd, 'dl.
Labials: p, b, f, w, m, mb.
VOWELS: a, ā, â, ä, e, ē, ĕ, (the primitive vowel), i, ī, î, o, ō, u, ū, û."

TYPICAL THIN SECTIONS OF THE ROCKS OF THE CUPRIFEROUS SERIES IN MINNESOTA*.

By PROFESSOR N. H. WINCHELL.

This paper was in pursuance of the same line of investigation as that by the same author read last year before the Association, but gave the detailed methods by which general results had been attained in the study of the stratigraphy of the cupriferous rocks. By means of the microscopic examination of the crystalline rocks of the series, two groups of rocks were discovered, one being those generally accepted as igneous by Pumpelly, Chamberlin and by Owen, and the other the result of change from the sedimentaries. The former one dark colored and heavy, consisting essentially of labradorite, augite and magnetite, but the latter are lighter colored, generally showing a reddish tint, and consist essentially of orthoclase, quartz and hornblende. It is the latter group that in this connection possesses the greatest interest, as the author regards them as the true equivalents of the shales and sandstones that in some places are seen interbedded, without metamorphism, with the igneous rocks of the other group. They play a very important part in the geology of northeastern Minnesota, where, in their varied lithology, exhibiting different stages of crystallization, they not only are spread over a large geographical area, but afford some of the most interesting geological studies.

The author suggested that probably the titaniferous iron ore which is so largely associated with the igneous rocks of the cupriferous series, had its origin in the ferruginous shales of the sedimentary series, by the reduction of the oxides with which they are colored, at the time of the igneous disturbances.

The paper was accompanied by a series of fifty thin sections made by the author, with brief descriptions, and by samples of the rocks from which they were taken, intended to illustrate the lithological distinctions pointed out.

* Read before the A. A. A. S., Cincinnati, 1881.

WORKED SHELLS IN NEW ENGLAND SHELL-HEAPS.*

By PROF. EDWARD S. MORSE.

Mr. Morse called attention to the fact that heretofore no worked shells had been discovered in the New England shell heaps. A similar absence of worked shells had been noticed in the Japanese shell heaps. Worked shells were not uncommon in the shell heaps of Florida and California. Mr. Morse then exhibited specimens of the large beach cockle (Lunatia), which showed unmistakable signs of having been worked. The work consisted in cutting out a portion of the outer whorl near the suture. To show that this portion could not be artificially broken he exhibited naturally broken shells of the same species, both recent and ancient, in which the fractures were entirely unlike the worked shells.

A REMARKABLE INSTANCE OF RETENTION OF HEAT BY THE EARTH.†

By H. C. HOVEY.

The fact is well known that heat may be retained for a long period by the rocks and soils of the earth; but it is seldom that dates can be fixed with approximation to accuracy as can be done in the instance the particulars of which are now given.

My attention was called, a year ago, by Mr. James Hudson, manager of the Albion mines, in Pictou county, Nova Scotia, to a peculiar area including about two acres of ground, where the snow never lay long without melting, and the frost, even in severe winters, never penetrated but for a short distance. All over this space are scattered fused masses of clay and ironstone, resting on the outcrops of what are locally known as the "Main" and the "Deep" seams of bituminous coal, which at this point are about 450 feet apart and partially affecting the outcrops of other seams. On inquiry as to the probable date of the fire that had left this area of scoriæ and ashes, I was told that this portion of Nova Scotia was visited early in the seventeenth century by French explorers, and that an account of the harbor called Pictou was given in 1672 by Monsieur D'Enny, who was appointed Governor of the Gulf of St. Lawrence in 1654. The name "Pictou" is said to be derived from a Micmac word signifying *fire*; and the traditions of the Indians still point to this locality as having been, a long time ago, the scene of a fierce and long-continued fire, which made them avoid the place as being visited with the anger of the gods.

The coal measures of Pictou were discovered in 1798, at the very point now described; and the discoverers represented the spot as covered with ashes, over which grew large hemlock trees. About twenty years ago, while a drain was being dug in this locality, a tree was cut down that showed 230 rings of annual growth; and three feet below the root of this tree a large piece of wood, fashioned by some sort of axe, was found in a good state of preservation. It is Mr. Hudson's opinion that at least 300 years must have passed since the extinction of the fire at this point, and it is known that none has been rekindled since; its ignition may have been effected by chemical action, or by a stroke of lightning, or by artificial means applied to one of the so-called springs or feeders of inflammable gas that issue along the outcrops of these unusually thick seams.

Last spring it was found necessary to sink a small pit at the crop of the Deep seam on this area, in doing which

* Read before the A. A. A. S., Cincinnati, 1881.

† Read before the A. A. A. S., Cincinnati, 1881.

the facts were obtained concerning the long retention of heat by the earth, to which I have already referred. Mr. Edwin Gilpin, Government Inspector of Mines, has kindly placed at my disposal what information he could gather on the subject, which I give, using, to some extent, the language of this careful and accurate observer. Mr. Gilpin has prepared a comparative view of sections of the same strata, made only a short distance apart, the design being to exhibit the changes made by igneous action.

The *present section* is taken at the new pit sunk by the Albion Mines Company on the burnt area; and what is termed the *original section* is one given in Sir William Logan's Report of the Geological Survey of Canada, 1869, p. 69. The distance between the localities where these two sections were made is so small that the comparison is at least instructive, and answers our purpose as well as anything that can be had.

PRESENT SECTION.	ft. in.	ORIGINAL SECTION.	ft. in.
Surface of burned clay	22. 0	Black, argillaceous shale, with many bands of iron-stone 1 to 2 inches thick. Total thickness 144 ft. 6 in.	2. 6
Band of hard scoriæ	4. 0	Brown carbonaceous shale	1.10
		Bad coal	0. 2
Reddish ashes	3. 0	Good coal	3. 7
Hardened shale	2. 0	Black shale with iron-stone bands	1. 2
Good coal (being upper part of the Deep Seam)		Good coal	3. 5
		Coarse coal	0. 8
		Good coal	3. 9
Depth of Pit	32. +	Coarse coal	0.11
		Good coal	3. 4
		Coarse coal	5.10
		Total thickness of the Deep Seam	22.10

The surface cover consists of clay, with boulders of sandstone and layers of gravel. The small portion of the 144 feet of black argillaceous shale filled with ironstone balls, passed through by the shaft, has been converted into an almost continuous mass of scoriæ, very hard and compact, and difficult to drill through.

The next layer represents the upper portion of the deep seam, which has been completely burned away, leaving a *compact, laminated reddish ash*. And it was in this ancient bank of ashes, known to be more than 300 years old, that the retention of heat was observed, which it is now my object to place on record. Immediately on opening the pit, the heat of the ashes, at a point 30 feet below the surface, was tested by a reliable thermometer, and was found to be 80° Fahr. at a time when the surface temperature varied from a minimum of 45° to a maximum of 65° Fahr.

Soon after an opening had been made through the pit to the workings in the mine, the air-currents caused the temperature rapidly to fall to the normal point.

The consideration of the gradual radiation of the heat of the earth suggests the idea that abnormal increases in the temperatures of deep mines may be due in some cases to the presence, at comparatively short distances, of masses of heated matter, which are, geologically speaking, modern, though they may be historically ancient.

RECOVERY OF OLD VULCANIZED CAOUTCHOUC.—The pieces are heated in contact with steam, when the sulphur is volatilized and the caoutchouc melts and is collected as a liquid, used in preparing water-proof covers, etc.

RADIOPHONY.—Professor Mugna, repeating M. Mercadier's experiments, in which an intermittent beam meets a smoked surface within a glass tube, containing aqueous or ammoniacal vapor, and furnished with an ear tube, adds to the effects by attaching a small microphone to an elastic membrane closing the tube. By this means he finds it possible to operate at a sufficient distance from the interrupting disc to render its noise no longer disturbing.

PILOCARPIN:—ITS ACTION IN CHANGING THE COLOR OF THE HUMAN HAIR.*

BY D. W. PRENTISS, M. D. Washington, D. C.

Pilocarpin is an alkoloid of Jaborandi and the active principle.

Jaborandi is a Brazilian drug recently introduced into medicine.

The leaves are the offic'al part of the plant. (Pilocarpus Pennatifolius.)

The effect upon the human system is powerful and peculiar.

(It produces profuse sweating and salivation, and stimulates the growth of the hair.)

Two cases were reported.

In the first case, the medicine was given to relieve uraemia consequent upon suppression of urine due to *Chronic Pyelitis.*

The patient was a lady twenty-five years of age, a blonde of petite figure.

The pilocarpin (hydrochlorate) was administered by hypodermic injection, commencing December 16, 1880. and being continued at intervals until February 22, 1881. The usual dose given was one centigram, but on several occasions this dose was doubled.

The object of its use was to eliminate urea from the system by sweating and salivation.

The immediate effect produced was profuse sweating and salivation, calculated to amount to not less than fourteen pints. (See Phila. *Med. Times*, July 2, 1881.)

The result to the patient on each occasion was great exhaustion, but the ureamic symptoms were relieved.

Twenty-two "sweats" were administered in all, and from thirty-five to forty centigrams of *pilocarpin were used.*

CHANGES IN THE COLOR OF THE HAIR.

Specimens of the hair were exhibited to the section, as also a colored plate showing the changes in the color.

Two specimens dated respectively November 1879, and November, 1880, were of a very light color, tinged with yellow, and showed that the color of the hair had not changed during that year.

The third specimen dated January 12, 1881, was a chestnut brown, and the fourth dated May, 1881, almost pure black.

The administration of the Pilocarpin began December 16, 1880, the change was first noticed December 28, 1880, and was thenceforth progressive.

In addition to the change of color the hair has become thicker and coarser than formerly, and while previously dry, is now quite oily.

The hair on other parts of the body is also changed in color.

The eyes have become a much darker blue.

In the second case, the Pilocarpin was administered to an infant fourteen months of age, afflicted with Membraneous Croup. (See Phila. *Medical Times*, August 13, 1881.)

The treatment was commenced June 19, 1881; two milligrams of hydro-chlorate of Pilocarpin being given every hour, afterwards increased to four milligrams every hour. It was administered for nine days, the amount being diminished towards the last.

The first specimen of hair was taken June 17, 1881, and the second June 27, 1881.

The color of the first is light yellow, and the second is a decided shade darker. This effect, of changing the color of the hair, if subsequent experience shall confirm it, adds another to the marvellous influences of Jaborandi on the human system.

The *modus operandi* of the change is still to be determined. It is probably connected with the fact that Jaborandi stimulates the nutrition of the hair.

* Read before the A. A. A. S., Cincinnati, 1881.

There appears to be reason to believe that the color of the hair is due to an oily pigment, and that this is increased under the influence of Jaborandi.

Shaving the scalp usually has the effect of making the hair thicker and darker, on the contrary, as age advances and the processes of nutrition are enfeebled, the hair becomes thin and dry and whitens.

THE CONSTITUTION OF THE "ATOM" OF SCIENCE.*

By MRS. A. B. BLACKWELL, SOMERVILLE, N. J.

[Abstract.]

This paper developed the hypothesis that in each atom of matter a given quantity of force and extension are conditioned by each other to act in special modes, rigidly adjusted in time and space. All atoms react against many opposed and unlike forces simultaneously, hence each atom must be a highly complex (not compound), elastic structure, which, by its changes in space, gives the direction, extent, rate of vibration, and all modes and transformations of the atomic force.

We can explain this variety and change of action, if we suppose every atom to alternately expand and contract unlike filaments or poles that act and react in vibrations towards and from a common axis, which is at rest. No point outside this axis can be at rest, except when held in equilibrium by other atoms. Reaction is equal and opposite between every part of the atom, and between it and all other atoms. Chemical combination is the interlocking, the literal intertwisting of certain poles of the combining atoms. Such combination brings to rest, makes latent, the opposed combining poles, wholly or in part; the more completely this is done the greater the transformed motion called heat, and the more stable the compound.

In combining, the uniting poles are massed or knotted, as any intertwisting cords would be, and many-atomed molecules require no extra room for their vibrations; but all gases contain equal numbers of molecules to the volume. But the atomic axes are shifted to a common centre; and thus the vibrations of all the free poles are more or less modified, according to the number and kind of the combining factors; they are always so far modified that the molecules of any compound vapor cannot repel those of either of its constituents, nor those of any unlike vapor—the explanation being that the periods of greatest expansion, the stretch outwards in their free poles are not synchronous. In like molecules they are synchronous, and the free poles, striking at any point short of greatest expansion, drive the atoms asunder. We call them mutually repellant. The action of all repulsive forces will admit of similar explanation. Push or strain in one direction compels counter-push or strain in another direction; hence opposed electricities, magnetisms, and polarization in general.

Gravitation may be considered the concurrent result of brief intertwisting of the physical poles; cohesion and crystalogenic energy represent more permanent interlocking. But chemical and physical combination are supposed to be alike in kind—the result of opposed, adapted mechanical energy. Chemical action in general produces more radical changes in the sensible properties of substances, because, taking the initiative, it sifts the atomic axes, and subsequent combinations are but in accommodation to these previous changes.

The hypothesis attempts to give a fairly adequate explanation of material changes; of the *how* and *why* of such changes.

The unlike elements of matter are supposed to be conditioned in special groups, but are essentially of the same type, and their changes are all in time and space only. There is held to be a higher type of atoms in the living sentient, or "mind matter" group, which we know only through their active organisms. In these atoms, force is conditioned both by extension and by intensiveness, and not in time and space alone—as with simple matter, but in time and space and sentience.

Possible changes in sentience, emotion, may be nascent in these atoms just as complex motion is nascent in all uncombined or but little combined atoms. Complexity of action in molecule and larger mass against which any atom must react in equal measure and opposite directions, compels complexity in the atomic reactions, and in the higher type of atoms one phase of all these reactions represents changes in sentience-sensations, thoughts, volitions.

Molecular complexity sufficient to excite a pleasurable degree of feeling would tend instinctively to repeat itself; hence the rise of organisms. The organism is the sentient atoms everchanging active molecule; and organic growth is adapted to the more and more complex sentient states. Decadence means failure in such adjustments. Sentient changes vary all the way between the low sentient state of profound sleep and the most alert phase of self-consciousness, but they are all individual or atomic changes. This hypothesis claims to offer an explanation of the joint facts both of matter and of mind.

* From the A. A. A. S., Cincinnati, 1881.

BACTERIA AND THEIR RELATIONS TO PLANT CULTURE.

BY THOMAS TAYLOR, MICROSCOPIST, OF THE DEPARTMENT OF AGRICULTURE.

If we examine, under a high power of the microscope a small portion of the scum of a fermenting infusion of vegetable matter, numerous particles of a globular shape will be observed, measuring about one twenty-thousandth of an inch in diameter, uniform in size and shape, highly refractive and frequently found in gelatinous masses. These are known as micrococci, or spherical bacteria. Associated with them is generally found another description of germs of the same diameter, but of a rod-like shape, jointed and of various lengths. In common vegetable fermenting infusions they are seldom observed over .003 of an inch in length, and are frequently under .001 of an inch. They have generally an active motion, as seen under a high power (as have also the micrococci), and are known as rod-bacteria (from bacterion, a staff). Botanists of the present day assign both of these organisms to the division algæ.

Many investigators believe that certain species of these organisms produce contagious fevers, but there certainly are other species which perform a most useful part in the economy of nature, and in many of our valued industries their active co-operation is absolutely necessary. It is well-known that they are the chief agents of fermentation and putrefaction, and it is to the decomposing power they thus exert, in conjunction with the action of the elements, that all organic bodies decay and restore to the earth soluble fertilizing salts, instead of the insoluble and therefore unavailable material of which, in their unchanged state, they are made up. There is high authority for stating that organic substances are not inherently unstable. Under suitable conditions they may remain for an indefinite period wholly unaltered. It is well-known that in some portions of the earth the carcasses of dead animals tend to dry up and become mummified. In the arctic region the remains of animals imbedded in ice are kept in perfect preservation for centuries. It is only under conditions more or less favorable to the existence and multiplication of the small organisms which produce fermentation and putrefaction that rapid decay takes place.

Without bacterian fermentation the compost heap of

Read before the A. A. A. S., Cincinnati, 188

the farmer would remain valueless as plant food. The stubble and the dead grasses of our fields, and the fallen leaves, twigs, branches and trunks of trees would remain comparatively unchanged but for the chemical action excited by the same agency. Fish guano, and all unfermented organic fertilizers, must undergo bacterian fermentation or putrefaction after their application to the soil, or they will remain in a stable form, and their ammonia, locked up in the tissues of which it forms a component part, will fail to yield its return of profit to the farmer. It is asserted that the great nitre beds of India owe their origin to the action of microscopic germs, and the production of nitrate of lime by artificial means presents a similar instance of the results of bacterian action. In this last-named operation animal and vegetable matter combined with lime is laid out in great beds and left for a period of two years, or until fermentation and putrefaction, coupled with the action of the air, have produced nitric acid, when nitrate of lime is formed, to be subsequently converted into nitrate of potash.

Some of the most beautiful colors used in dyeing are produced by subjecting lichens to bacterian fermentation, and the fermentation of stable refuse yields an even heat, which is extensively utilized in the manufacture of white carbonate of lead, as well as in the cultivation of mushrooms and of various early vegetables. The value of the edible fungi thus produced, alone amounts in Europe, Asia and America to millions of dollars per annum. The utilization of bacteria and similar organisms in the operations of baking and brewing, and the production of wine and vinegar, is familiar to every household.

While bacterian fermentation or putrefaction is an essential part of the process which fits dead organic matter to become food for plants, the former appears to be an incidental source of one of the common practical difficulties encountered by the farmer and horticulturist, viz.: the tendency of soils to become sour. Some of the lower forms of fungi are denominated "acid formers," and the mode in which these act will, I think, illustrate the process by which sourness of soil is brought about. If we dissolve a little sugar in water, add a small quantity of yeast fungus, and subject the solution to a suitable temperature, fermentation ensues—the sugar is converted into alcohol and carbonic acid, and in process of time the alcohol is oxidized, becoming acetic acid. As the result of some late observations, I am convinced that a similar change often takes place during the progress of those fermentations of which bacteria are the agents, and that these organisms, though in a less distinctive sense, might also be called " acid formers." So far as my observation extends, solutions in which bacterian ferments are in active progress, invariably become acidulated, and I have also found that soils in which bacteria and micrococci are revealed by microscopic examination—and I find them in all soils of average fertility—give perceptible acid reactions when tested by litmus paper.

That acidity is so often produced in excessive quantities may be due in part to the character of the unmarketable substances left upon the land in the operations of agriculture, such as the stalks of corn, the stubble of the smaller cereals, decayed grasses, the fallen leaves and twigs of fruit trees, and the roots of field and garden plants in general. In all of these there is a preponderance of cellulose, which substance is resolvable successively into starch, dextrine and glucose, and from this last, as from the solution of sugar in the experiment above referred to, is ultimately produced acetic acid.

The neutralization of the excess of acid in the soil is not the least of the ends subserved by the use of lime and other alkalies in agriculture; but another means which contributes to keep its quantity within wholesome limits is thorough drainage. If the soil of potted plants be not watered with sufficient frequency and copiousness it soon becomes sour, and gardeners have learned by experience to leave at the top of each flower-pot a water space of two inches, more or less, depending on the size of the pot. By filling this space with water as often as necessary the soil is kept sufficiently free from organic acids, which are washed out through the aperture below; and this is precisely similar to what takes place in any well-drained field.

I have already referred to the opinion that certain species of bacteria produce contagious fevers; but from what has been said above, it will be sufficiently apparent that this is by no means the chief function of this class of organisms. However great their baneful activity at times may be, their services to man and to organized existence in general are infinitely greater. Moreover, the former is but occasional and sporadic, while the latter is practically constant and universal. If the materials once used by the life principle in building up organic bodies could not be used over and over again for the same purpose, life must soon cease through the exhaustion of all that is capable of sustaining it. It is in that which has lived, but lives no longer, that life finds the greater part of its sustenance; but, as we have already seen, that vegetable life upon which all animal life ultimately depends can not use this sustenance in the form in which life left it. Before organic matter is available as plant food, it must be reduced almost to its primitive elements; and, as has been pointed out, its reduction is mainly effected through those processes of fermentation and putrefaction, in which bacteria appear to be the most active and important agents. Thus we find among those simple forms of life, which are supposed to have been the first to make their appearance on our planet, and to which, if we accept the theory of evolution, even the most complex of existing organisms owe their origin—an agent which, from the very inception of life upon the earth, has continuously performed a function without which the successive generations of plants and animals could not have existed; and stupendous as is its work, it is an agent so minute that twenty million individuals of its class might be inclosed within a globe small enough to pass through the eye of a cambric needle.

ANCIENT JAPANESE BRONZE BELLS.*

By Prof. Edward S. Morse.

Mr. Morse described the so-called Japanese Bronze Bells which are dug up in Japan. These bells had been described and figured by Prof. Monroe in the Proceedings of the New York Academy of Sciences. Mr. Kanda, an eminent Japanese archæologist, had questioned their being bells from their peculiar structure.

Mr. Morse had seen a number of bells of different kinds, some of considerable antiquity, but none of them approached these so-called bronze bells. Mr. Kanda had suggested that they were the ornaments which were formerly hung from the corners of pagoda roofs, but the fact that none of them showed signs of wear at the point of support, rendered this supposition untenable. Mr. John Robinson, of Salem, the author of a work on Ferns, had given the first suggestion as to the possible use of these objects. He has asked why they may not have been covers to incense burners. Curiously enongh, old incense burners are dug up which have the same oval shape that a section of the bell shows. The bell has openings at the base and also at the sides and top, so that the smoke of burning incense might escape. It is quite evident that these objects are neither bells nor pagoda ornaments, and this suggestion of Mr. Robinson's may possibly lead to some clue regarding their origin.

Electric Motive Power for Omnibuses.—The Faure accumulators have been tried again by the Paris omnibus company on a tramway with a carriage arranged for the purpose. The experiment is said to have been highly successful.

*Read before the A. A. A. S., Cincinnati, 1881.

TIME SERVICE OF CARLETON COLLEGE OBSERVATORY, AT NORTHFIELD, MINNESOTA.*

WILLIAM W. PAYNE.

The observatory of Carleton College is located at Northfield, Minn., forty miles south of St. Paul, on one of the main lines of the Chicago, Milwaukee and St. Paul Railway. It was built in 1878. Its latitude was determined by Professor B. F. Thomas in 1879, by a series of observations made with a Würdemann zenith telescope of two-inch aperture loaned to the Observatory for that purpose by Lieut. Edward Maguier, Chief Engineer of the Department of Dakota. He used the Talcott method and found the latitude to be $44° 27' 41'' \pm$. In August, 1880, the work was done a second time by myself, using the same instrument and method, and observing forty pairs of stars from Sofford's catalogue on three different nights. After the proper reductions the latitude was found to be $44° 27' 40.''8$.

In October, 1880, by the aid and courtesy of the officer just named, and Lieut. O. B. Wheeler, of the Lake Survey Corps, the longitude of the observatory was determined. The Coast Survey meridian of St. Paul was used as the base of operation. Observations were taken at both points on two different nights and telegraphic signals were exchanged. Independent reduction of the observations showed the longitude of the Observatory to be $1^h\ 4^m\ 23^s.85$ west of Washington and 14.3 seconds west of the meridian of St. Paul.

INSTRUMENTS.

The Observatory is furnished with the following instruments:

A Clark Equatorial, 8¼-inch aperture, 10½ feet, with complete mounting.

A Byrne Equatorial, 4.3-inch aperture, with portable mounting.

A Transit made by Fauth & Co., Washington; telescope of 3-inch aperture and 42-inch focal length with reversing apparatus.

Two Howard clocks with electric and magnetic attachments for use in regulating and sending time.

A Bond Siderial Chronometer with break-circuit and an ordinary Clark Chronograph.

TIME SERVICE.

The time service of the Observatory began October 23, 1878, immediately after the clock was set and regulated, the N. W. Telegraph Company (now Western Union) having previously asked for time, and having built a line to the Observatory and furnished it with a telegraph office.

The electrical time-signals are given by the mean time clock which has a break-circuit attachment operated by a small wheel on the shaft carrying the seconds hand. This wheel, which contains thirty-one teeth, spaced to represent two seconds except three which give continuous seconds to mark the close of each minute. This clock is placed in a local circuit with appliances for cutting it into the main telegraph lines for daily, noon signals. By arrangement with the railroad companies the clock is put into line before twelve daily and thus give *three* full minute signals, the last stroke of the third minute being the time of twelve exactly.

Until recently the distribution of the time has been effected in the following manner:

The principal officers of five of the seven different railroads centering in St. Paul and Minneapolis were connected with the main office of the Chicago, Milwaukee, and St. Paul Railway either directly or at some intersecting point, and in this way our central mean time clock has daily operated all the main lines of these companies. The branch lines use the same time, having it repeated by hand. When the main lines are thus connected the clock has given its break-circuit signal distinctly over 1285 of wire in six different States and territories and ranging from Kansas City to St. Paul, Winona and McGregor in Iowa.

For a few weeks recently, the signal has been modified by reversing the points of the relay in the local circuit for the purpose of a make circuit signal on the main line. A five minute signal attachment has also been applied to the clock that time balls may be dropped at noon daily in connection with our railroad time service. Arrangements are already made to drop a time ball in each of the cities of St. Paul and Minneapolis, apparatus for the same being already in hand.

The five-minute attachment, as it is called, that aids in dropping these time-balls, is a plain disk attached to the train of the clock so as to revolve once in five minutes; a portion of the circumference representing fourteen seconds is cut away. This disk is placed in the local circuit and serves to keep it closed, and hence main lines open during fourteen seconds preceding the *sixtieth one* before noon. The interval gives opportunity to connect time-balls with electrical apparatus for dropping the same by the single twelve o'clock stroke from the clock. The dropping apparatus that I use for these balls is manufactured by Prof. H. S. Pritchett, of St. Louis. It is neat, simple and effective.

DISTRIBUTION OF THE TIME.

The following railroad companies take the Northfield meridian time directly or indirectly, and use it over their lines without change.

	Miles.
1. C. M. and St. P. R'y, on its five divisions West of the Mississippi now embracing an aggregate length of	2271
2. W. & St. Peter R'y, (branch of N. W. R'y,) uses both Northfield and Barabvo signals but runs on Northfield time West of the Missisippi	484
3. St. P. M. & O. from Sioux city to Elroy Wis., on all its branches	963
4. M. & St. L. R'y, from Minneapolis South	260
5. Northern Pacific Railway to the end of its track	680
6. St. P. M. & M. certainly to St. Vincent and (I think to Winnepeg)	630
7. St. P. & Duluth	153
Making a total of	5541

The last two companies named do not take time directly from the observatory but from jewelers in the city of St. Paul who receive our daily signals.

It will be seen readily by inspecting a map that the territory traversed by these great railroads embraces all of Minnesota and forts of Iowa, Nebraska, Dakota, Wisconsin, Montana, and probably the Province of Manitoba.

* Read before the A. A. A. S., Cincinnati, 1881.

CHANGES IN MYA AND LUNATIA SINCE THE DEPOSITION OF THE NEW ENGLAND SHELL HEAPS.*

BY PROF. EDWARD S. MORSE.

This communication embraced a comparison between the shells peculiar to the ancient deposits made by the Indians along the coast of New England, and similar species living on the coast at the present time. Mr. Morse referred to similar comparisons which he had made in Japan, wherein he had found marked changes to have taken place; changes which showed that the proportions of the shells had greatly altered.

He had made a large number of measurements of shells from a few shell heaps of Maine and Massachusetts, and had obtained very interesting results. The common

*Read before the A. A. A. S., Cincinnati, 1881.

clam (Mya) from the shell heaps of Goose Island, Maine; Ipswich, Mass., and Marblehead, Mass., in comparison with recent forms of the same species collected in the immediate vicinity of these ancient deposits, showed that the ancient specimens were higher in comparison with their length than the recent specimens.

A comparison of the common beach cockle (Lunatia) from the shell heaps of Marblehead, Mass., showed that the present form had a more depressed spire than the recent forms living on the shore to-day, and this variation was in accordance with observations he had made on similar species in Japan.

AMERICAN COAL FIELDS.

The areas of the anthracite coal fields, confined to a few counties of our State, are so well defined that we need be in no doubt as to their extent; and this limited area admonishes us that we should carefully husband our inheritance, and not waste it. The fact is well established, that for every ton shipped to market, two are wasted. The loss in the operations of mining, the pillars left to support the roofs of the mines, the loss in preparation, each contributes to this great aggregate. How to prevent these losses, by use of improved machinery, and by more thorough methods of working the mines, should be the study of our mining superintendents and engineers. Several suggestions with a view to a partial remedy, present themselves.

First.—The owning of the land by the operators would make them careful to mine all the coals. As tenants for a limited term of years, their object is merely to take out that coal, and in such a manner as will cost them little, and bring them much.

Second.—If the lands are to be leased, the term should be long enough to enable them to mine all the coal beds covered by the lease.

Third.—The lease should contain clauses subjecting the methods of mining, ventilation and drainage to the supervision of the owner's mining engineers; limiting the lengths of "breasts" to seventy yards or less; forbidding the use of monkey rolls, or the rebreaking of the coal; providing for the dumping in separate heaps of the coal dirt and the slate and rock.

Fourth.—We need larger collieries, and fewer of them, with perfected machinery, for hoisting, pumping and breaking.

Fifth.—More capital is required to open the mines for extensive and exhaustive working, by driving the gangways to the extreme ends of the territory, and then mining towards the outlet, so as to obviate the necessity of retracing our steps and robbing the pillars.

In Schuylkill county we are specialists. We are dependent upon one substance: coal is king. There is no gold, silver, lead, copper, or other valuable metals. Though we have good iron ores, they are so disseminated as not to furnish us one workable bed. Yet we largely help Pennsylvania to furnish nearly halt the iron manufactured in the United States. We have a large farming area well cultivated by our industrious and frugal German farmers. Our convenient location to the great markets of the Atlantic seaboard, our canals and abundant railroad facilities, our great commodity, always give a promise and an attitude among the great countries of our grand old commonwealth, which we are ever proud to realize.—*Geology of Schuylkill County, by P. W. Scheafer. Pottsville, Pa.*

The latest addition to microscope stands is the swinging sub-stage. This American invention has been adopted by most of the English manufacturers. In the last number of the *Journal of the R. M. S.* we find the value of the swinging sub-stages disputed by Mr. Crouch, and that Mr. Stevenson concurred in this view, and described them as useless incumbrances and unsuitable for use with certain apparatus, which is essential to the display of some objects.

ASTRONOMY.

COMET C (SCHÄBERLE), 1881.

This comet has been observed here since the 16th of July. When first seen it was large, round and bright, and slightly condensed at the centre, being very plainly visible in a 1¼-inch telescope. On the morning of the 19th it had increased sensibly in brightness; a faint tail could be traced for a distance of fully 15′, pointing in a northwesterly direction; on the above date its position was obtainee from θ (*Theta*) *Aurigas* in the following manner: Thd comet and star were separated too far to be both seen in the field of the telescope together, the comet was also too far north of the star for both objects to be seen at once in the finder. One of the wires in the finder eye-piece was made parallel with the meridian, and then the star, which preceded the comet, was brought into the field and its passage of the wire obtained; the telescope was then carefully moved northward in declination until the comet, entered the field when its passage of the wire was observed; in this manner the difference of R. A. was obtained; the difference of declination was then estimated. From a mean of several passages of the star and comet its position on July 18th at 15h. 40m., Nashville mean time, was found to be R. A. 5h. 52m. 52sec., and Decl. 40° 15′. The R. A. will be very little out, but the declination may be over a minute in error.

Its position was obtained in the same manner on the 20th (A. M.), using the same star at 3h. 35m., R. A. 5h. 53m. 54sec., Decl. + 40° 42′, with probably several minutes of error in the declination. On July 24, at 15 hours, the comet was visible to the naked eye, appearing about as bright as a sixth magnitude star (Prof. Swift, of the Warner Observatory, saw it with the unaided eye as early as the morning of the 23d).

On the 28th a small star-like nucleus was visible with the telescope.

Aug. 3 (A. M.), it was very easily visible with the naked eye, traces of the tail being seen without a telescope. A naked eye comparison with comet B showed C to be the brighter. Comparing it with a six magnitude star it was of the same brightness, but, covering a larger area, it was more noticeable than the star. The tail, in the telescope, was long and slender and straight as a shaft.

Aug. 4 (A. M.), the comet was quite conspicuous with the unaided eye, the tail stretching out for some distance. In the telescope the nucleus was small, round and pale, and star-like in form, Turning the telescope from comet C to comet B, the two were identical in brightness, but B was slightly broader about the head and tail, and the nucleus was not so distinct; but considering the low altitude of C it must have been really much brighter than B.

On August 14 it was visible in the evening after sunset, being quite plainly visible to the naked eye, with its tail streaming upwards for several degrees. In the telescope it was many times brighter than comet B.

21 inst., in the evening, the comet was as bright to the eye as a 3½ mag. star. It appeared very graceful, straight and slender in the telescope. On this occasion I obtained its position with the aid of a ring micrometer, referring the comet to *Psi ursæ minoris*.

1881, August 21 ds., 14.1m. Washington, m. t. $\left\{ \begin{array}{l} a = 11h.\ 08m.\ 08.5s. \\ \delta = +45^\circ\ 13'\ 42'' \end{array} \right.$
This was the *apparent position.*

22 inst., evening, its tail could be traced with the telescope for a distance of about 6°, and was visible to the naked eye for about the same distance. A faint lightish stripe was visible on this date, extending from near the head to a degree or so along the middle of the tail. The following side of the comet's head and tail were distinctly defined, the sky appearing quite dark up to the very body of the comet, but the preceding side was ill-defined and blended, the sky being whitish for some distance from the comet; there also appeared to be a diffused sort of short tail running out some 10′ or so from the n. p. side

of the head; the nucleus was small and not very well defined.

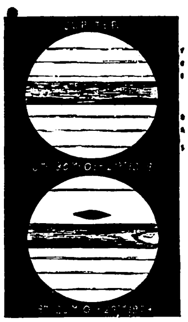
This comet differs considerably in general appearance from the comet now in *ursæ minor*. The head of B was large and broad, and its tail spread out greatly. Comet C has a small, narrow head with a very long slender shaft-like tail running from it in a straight line.

E. E. BARNARD.

NASHVILLE, TENN., *August* 26.

JUPITER.

The following cut represents the planet Jupiter on October 21st and October 29th, 1879, as seen with the 18½ inch Chicago refractor, with power 638.



The numbers on the right indicate the faint belts, which were systematically arranged on either side of the planet's equator.

The great Equatorial Belt, crossing the center of the disc, was composed of two separate belts, being divided by an irregular rift extending through the central portion. The color of this belt was reddish-brown-brick color, and the total width was 15,780 miles.

The great red spot shown in the center of the disc, on October 29th, was essentially of the same color as the equatorial belt, only more brilliant; it was about 30,000 miles in length and 8000 in breadth. Under fair atmospheric conditions, the equatorial belt was always visible up to the edge of the disc, with very slight diminution of color.

CORRESPONDENCE.

COMET *b*., 1881.

HARVARD COLLEGE OBSERVATORY,
CAMBRIDGE, U. S. *September* 13, 1881.

To the Editor of "SCIENCE."

SIR:—The spectrum of comet *b*, 1881, according to Dr. Konkoly (*Observatory*, 53, p. 257) contains five bright bands. From the mean of measures made with different spectroscopes on different nights, their wavelengths in millionths of a millimetre were found to be 560, 545, 515, 472 and 468. The first, third and fourth of these bands are evidently due to carbon and, as Dr. Vogel has shown, are coincident with those of the banded stars of Secchi's fourth type. The other two bands appear to coincide with those of Ll. 13412. Last winter the spectrum of this star was found to consist mainly of bands having wave-lengths 545, 486 and 466 (*Nature*, xxiii, 604). The line 486 is probably due to hydrogen. The singular kinship of comets and banded stars is thus confirmed by a star whose spectrum seems to be quite unique.

EDWARD C. PICKERING.

To the Editor of "SCIENCE."

About two weeks ago, I found that one of the turtles which I keep for experimental purposes, a *Chrysemys picta* had laid eggs; all but one of these had been devoured whether by the turtle itself (as I have known to be the case with the same species, when kept in captivity) or by some alligators living in the same tank I could not discover. The perfect egg, I imbedded in moist sand, after carefully washing it, and finding yesterday, that it had not undergone development, I opened it and to my surprise found a living maggot, the larva probably of the *Musca vomitoria*, creeping around actively in the space between the half dessicated yolk and the shell membrane. It measured about four millimeters in length. As it crawled out of the aperture in the shell which I had made I threw the specimen away as it did not show the original anomoly.

Analogous observations have been made in the chick's egg. Cases are not infrequent where one egg has enclosed another or even several eggs, legs of beetles, wisps of straw and other foreign bodies. But this is I believe the first case where a living animal has been found in an egg. Of course the explanation of its presence is the same as in the case of the other substances referred to.

E. C. SPITZKA.

BOOKS RECEIVED.

ELEMENTS OF ALGEBRA, by G. A. WENTWORTH, A. M., PROFESSOR OF MATHEMATICS IN PHILLIPS EXETER ACADEMY, 8° BOSTON. Ginn & Heath, 1881; viii, 380 pp.

This addition to American a gebraic literature is the sort of book that is to be expected from a live teacher. It bears the stamp of experience upon it and gives evidence throughout of the one end and aim of teaching beginners in algebra the art of algebraic manipulation. We say the art rather than the science, because the aim is clearly to familiarize the pupil with the *art*, to teach him *how* to manipulate rather than to lay stress upon the reasons for the processes, the author being evidently a disciple of Thomas Hill in his belief "*Facts before reasoning*." This is shown by such statements as "From these it may be assumed, etc."; "It may be verified that, etc."

The author has paid "particular attention to brevity and perspicuity in definitions," a thing which cannot be too highly commended, and without which any algebra, however good in other respects, will not succeed.

This matter of definitions is, as every teacher understands, a very important matter, if not for the algebra itself, then at least as a matter of right training and clear thinking. Definitions should be memorized, but memorization is not enough; they must be thoroughly understood. With those teachers who do not agree with this view we will have no disagreement, for the student trained to thoroughly comprehend is generally found by that very process to have secured that definition in his memory. In a text book, therefore, which aims at clearness and brevity in definition, a valuable training is afforded the student by leading him to carefully weigh the definitions; to consider whether the definition can be curtailed without loss of clearness, or whether it be not already too brief to be intelligible; to consider whether it is too restricted or too extended in its application, etc.

With the view of emphasizing this important matter we shall call attention to some of the definitions in this book, and at the outset let us premise that the definitions of mathematical terms must conform to the usage of mathematicians. It is a well-known fact that certain features of text books, faults as well as excellencies, are faithfully reproduced. Witness the statement concerning the rotation period of one of the major planets, erroneously given in one of the earlier editions of "*Herschell's Outlines*," and this error faithfully copied into astrono-

mical text books for nearly half a century. Witness also those mathematical tables "independently computed for this work" containing errors identical with older tables. The definitions given by a professional teacher, whose knowledge is gained from and chiefly confined to text books, will therefore be found to differ from those of a mathematician, astronomer or physicist, whose conceptions are drawn from memoirs and documents differing radically from text books. If a mathematician, not a teacher, should write an algebra he would probably reflect usage of mathematical terms by mathematicians better than the teacher; at the same time the teacher might express himself with more clear conciseness and in a manner better adapted to the class room.

The differences pointed out above are illustrated in the work before us. A co-efficient is defined as a *known* factor, in accordance with the usual custom of defining it; it is certain that this restriction is not kept up even in algebraic text-books, as they speak of indeterminate (meaning undetermined) co-efficients. That the leading letters of the alphabet usually stand for known quantities is something which the student has to *un*learn as soon as he gets out of the elements, and often before, as is the case in this work when Interest, Annuities, etc., is reached. The statement (p. 27) that "it is usual to prefix to the parenthesis the sign of the first term that is to be enclosed within it," may be questioned.

"An equation" according to this book "is a statement that two expressions are equal." Suppose we make this statement: "One pound is equal to sixteen ounces," will not this conform to the definition and at the same time will it not fail to represent the algebraist's conception of an equation? According to the definition of "Equation of Condition" $x^2 = my$ is not an equation of condition. "To solve an equation is, to find *the* value of the unknown quantity," thus implying that there is but one value that will satisfy the equation, an impression that will subsequently require correction. The terms *cancel* and *reduce* so much used are not defined. The usage of the first is in accordance with general use but not in accordance with the usual definition. In fact no definition of it in any algebra (I am ready to be corrected) conforms to mathematical usage.

The definition of fraction is purely the arithmetical one in which the numerator and denominator are supposed to be integers and hence fails as a general definition, just as the definition of *index* or *exponent* fails through too great limitation or from tacitly assuming that a general symbol will only have special values.

In spite, however, of the points to which we have called attention above we consider this algebra a useful one. The numerous examples afford the student ample resources for getting practically familiar with algebraic manipulation, and the conspicuous absence of set rules compels the work to be done thoughtfully rather than by rule of thumb. Factoring, that important branch of algebra is fully treated, though the same can hardly be said of radicals. The chapter on logarithms is well done, much better than is common, and to our mind is decidedly the best chapter in the book. The book is well printed and attractive in appearance in spite of the lines at the top of the page and is very free from typographical errors. We have only noticed one, p. 349, Ex. 20, where $10 should read $5.

MARCUS BAKER.

U. S. COAST AND GEODETIC SURVEY OFFICE,
WASHINGTON, D. C., *August* 11, 1881.

METEOROLOGICAL REPORT FOR NEW YORK CITY FOR THE WEEK ENDING SEPT. 10, 1881.

Latitude 40° 45′ 58″ N.; Longitude 73° 57′ 58″ W.; height of instruments above the ground, 53 feet; above the sea, 97 feet; by self-recording instruments.

SEPTEMBER.	BAROMETER. Mean for the day. Reduced to Freezing.	Maximum. Reduced to Freezing.	Maximum. Time.	Minimum. Reduced to Freezing.	Minimum. Time.	THERMOMETERS. Mean. Dry Bulb.	Mean. Wet Bulb.	Maximum. Dry Bulb.	Maximum. Time.	Maximum. Wet Bulb.	Maximum. Time.	Minimum. Dry Bulb.	Minimum. Time.	Minimum. Wet Bulb.	Minimum. Time.	Maxi'm In Sun.
Sunday, 4	30.008	30.032	12 p. m.	29.950	0 a. m.	68.3	64.7	71	3 p. m.	66	3 p. m.	65	6 a. m.	62	6 a. m.	91.
Monday, 5	30.051	30.096	9 a. m.	30.008	6 p. m.	75.3	70.6	82	4 p. m.	75	4 p. m.	68	5 a. m.	66	5 a. m.	132.
Tuesday, 6	30.007	30.042	9 a. m.	29.988	4 p. m.	84.6	76.0	97	4 p. m.	81	4 p. m.	74	5 a. m.	72	5 a. m.	150.
Wednesday, 7	29.934	29.992	9 a. m.	29.894	5 p. m.	90.6	76.0	101	3 p. m.	83	6 p. m.	79	6 a. m.	73	6 a. m.	154.
Thursday, 8	30.031	30.088	9 p. m.	29.928	0 a. m.	79.0	71.3	89	2 p. m.	78	2 p. m.	69	12 p. m.	63	12 p. m.	133.
Friday, 9	30.003	30.082	0 a. m.	29.950	7 p. m.	73.3	68.0	78	4 p. m.	72	4 p. m.	68	5 a. m.	64	5 a. m.	96.
Saturday, 10	29.933	29.994	9 a. m.	29.900	12 p. m.	72.0	69.3	75	9 a. m.	71	9 a. m.	66	12 p. m.	65	12 p. m.	117.

Mean for the week .... 29.995 inches.
Maximum for the week at 9 a. m., Sept. 5th .... 30.096 "
Minimum " at 5 p. m., Sept. 7th .... 29.894 "
Range .... .202 "

	Dry.	Wet.
Mean for the week	77.6 degrees	70.8 degrees.
Maximum for the week,	at 3 pm. 7th 101. "	at 6 pm 7th, 83. "
Minimum " "	6 am. 4th 65. "	at 6 am 4th, 62. "
Range " "	36. "	21. "

SEPTEMBER	WIND. Direction. 7 a. m.	Direction. 2 p. m.	Direction. 9 p. m.	Velocity in miles. Distance for the Day.	Force in lbs. per sqr. feet. Max.	Force. Time.	HYGROMETER. Force of Vapor. 7 a. m.	Force of Vapor. 2 p. m.	Force of Vapor. 9 p. m.	Relative Humidity. 7 a. m.	Relative Humidity. 2 p. m.	Relative Humidity. 9 p. m.	CLOUDS. Clear, 0 Overcast, 10. 7 a. m.	Clouds. 2 p. m.	Clouds. 9 p. m.	RAIN AND SNOW. Depth of rain and snow in inches. Time of Beginning.	Time of Ending.	Duration. h. m.	Amount of water	OZONE. 0 10
Sunday, 4	s. e.	s.	s.	87	¾	11.30 pm	.516	.572	.599	83	75	84	8 cu.	9 cu.	9 cu.	-----	-----	-----	--	0
Monday, 5	s. w.	s.	s. s. w.	158	2½	0.50 am	.599	.717	.757	84	70	81	6 cu.	8 cu.	0	-----	-----	-----	--	0
Tuesday, 6	w. s. w.	n. w.	s. w.	81	¾	5.30 pm	.757	.741	.850	90	46	68	10	3 cir. cu.	1 cir. cu.	-----	-----	-----	--	1
Wednesday, 7	w. s. w.	w. n. w.	w.	122	2½	2.00 pm	.717	.559	.827	70	28	57	1 cu.	4 cir. cu.	1 cir.	-----	-----	-----	--	6
Thursday, 8	n. n. w.	e. n. e.	e.	117	1¼	3.20 pm	.690	.809	.529	70	59	74	0	10	10	-----	-----	-----	--	1
Friday, 9	e. s. e.	s. s. e.	s. e.	63	¼	4.00 pm	.529	.625	.693	74	65	85	10	10	10	-----	-----	-----	--	0
Saturday, 10	s. e.	n. e.	n. e.	104	7	8.40 pm	.706	.704	.635	90	81	89	10	8 cu.	10	10½ am 4.40 pm	11½ am 10 pm	1.00 5.20	.01 .08	9

Distance traveled during the week .... 732 miles.
Maximum force .... 7 lbs.

Total amount of water for the week .... .09 inch.
Duration of rain .... 6 hours, 20 minutes.

DANIEL DRAPER, Ph. D.

Director Meteorological Observatory of the Department of Public Parks, New York.